

# NEW FOSSILS FROM THE BASE OF THE CAMBRIAN IN SOUTH AUSTRALIA

(Preliminary Account)

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## SUMMARY

Two fossils from the Pound Quartzite of Ediacara are described. *Spriggina floundersi* nov. gen., nov. sp. represents a new family of the polychaete annelids apparently related to the Tomopteridae and with possible arthropod affinities. The other fossil is named *Parvancorina minchami*. Its position in the system is problematical.

In September 1957, two private collectors, Mr. H. Mincham of Adelaide, and Mr. B. Flounders of Whyalla, visited Ediacara, between Copley and Lake Torrens, where Sprigg (1947, 1949) had collected a rich fauna of fossil jellyfish. Mr. Mincham presented a number of fine specimens of this fauna to the South Australian Museum. Mr. Flounders forwarded 36 photographs of his finds to the Geology Department of the University of Adelaide for identification. Among them were known and new species of jellyfish, several tracks which have yet to be studied, and the four specimens here described. As they were obviously new, Mr. Flounders was asked to lend them to me for identification and description. He forwarded them immediately and I am very grateful to him for his willing cooperation. The specimens, marked E3 to E6 in his private collection, have since been donated by Mr. Flounders to the South Australian Museum. Three specimens represent external moulds of a segmented animal with a head and trunk complete with appendages. The fourth is an unsegmented organic structure of unknown affinities.

## DESCRIPTIONS

### ANNELIDA

#### Order POLYCHAETA ERRANTIA

#### Suborder NEREIMORPHA

#### Family SPRIGGINIDAE nov. fam.

Characters as described for the type genus.

#### Genus SPRIGGINA nov. gen.

*Diagnosis*—Body rather flat, head without external segmentation, with lateral extensions which give it roughly the shape of a horseshoe, trunk consisting of a very gently tapering series of segments, numbering up to about 40. Parapodia with acicular setae. Pharynx well developed, not exerted in the present specimens.

#### *Spriggina floundersi* nov.gen., nov.sp.

pl. 1, figs. 1-3

*Description*—The fossils are preserved as external moulds. The distinctive horseshoe shape of the head is visible in all three specimens. Between the curved, tapering and slightly divergent ends lies the impression of the pharynx, slightly to one side of the median line. This line appears as a distinct ridge in the matrix and was therefore a narrow groove on the body, presumably on its ventral side. Flanking it on both sides are the appendages which are apparently

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insegmented but divided into a proximal portion which is directed laterally and a distal portion pointing outward and backward, at a more or less distinct angle. This is observed in all three specimens but not equally clearly in all parts of the trunk. The distal portion is interpreted as an acicular seta. One specimen (E5) shows longitudinal impressions running along its sides parallel to the axis for more than one-half its length. They do not emerge from the lateral portion of the "head" but appear first behind it, apparently arising from the ends of the first parapodia. They are tentatively interpreted as their acicular setae. Though the impressions could be formed by narrow lines of bundles of setae along the flanks of the dorsal side of the trunk, this is considered less likely. The length of the appendages decreases gradually towards the posterior end of the body which is not differentiated into a tail. The larger specimens E3 and E5 each have about 40-42 pairs of appendages, the smaller specimen E4 which measures about 2/5 of their (presumably adult) length, has only about 20 pairs.

*Dimensions*—Spec. E3: Length along axis about 46 mm., greatest width of head about 10.5 mm., greatest width of trunk with appendages 11 mm.

Spec. E5: Length about 40 mm., greatest width of head 10 mm., greatest width of trunk with appendages 8.8 mm.

Spec. E4: Length about 15.5 mm., width about 5.5 mm.

*Holotype*—Specimen E3 (Pl. 1, Fig. 1).

*Type locality*—Ediacara (see Sprigg, 1947). The bed containing the specimens E3 and 5 was just below that containing the jellyfish (communication from Mr. B. Plouffers). Sprigg considers the beds containing the jellyfish to be about 100 feet below the top of the Pound Sandstone which is the base of the "Archaeocyatha" (or Ajax) Limestone of Lower Cambrian age.

*Age*—While Sprigg (1947) followed David in placing the Archaeocyatha limestones near the top of the Lower Cambrian, it is now known that boulders of this limestone occur on Kangaroo Island below the *Protolenus* zone which marks the top of the Lower Cambrian (Daily, 1956). The Archaeocyatha limestones are now placed in the lower part of the Lower Cambrian, and correlated with those containing (in their higher portion) Olcnellid faunas at the base of the Cambrian in Morocco and Western Siberia. It is therefore a question of definition whether the Pound Sandstone should be included in the Cambrian or in the uppermost Proterozoic. In any case the stratigraphic position of the Ediacara fauna is very close to the base of the Cambrian, as defined in other continents.

*Comparison and affinities*—This fossil is placed in the Annelida Polychaeta because of the general structure of its head and segmented body. No segmentation of the head or appendages has been observed. While it could be argued that the coarse grain of the sediment could have obscured the segmentation of the appendages, it is obvious that the head was not segmented. As undoubted fossil jellyfish occur abundantly at this locality, it is not necessary to assume a strongly chitinous or calcified integument to account for preservation of this fossil. It could well have been soft-bodied, except for the terminal bristles of the appendages which left straight rather sharp impressions. The head presents unusual features. They can be compared with the head of the living family Tomopteridae Grube. This family is defined as follows (Hempelmann, in Kükenthal and Krumbach, 1931): Body somewhat flattened with three regions: head, trunk and tail, the latter absent in some species of *Tomopteris*. Two laterally directed tentacles, two nuchal organs, two eyes, one pair anterior acicular cirri which contain a small aciculus and are occasionally absent in adults. One pair strongly developed tentacular cirri, each with a strong acicular seta. Eversible proboscis without teeth. Parapodia bilobate, without acicular setae or bristles but with leaf-shaped terminal expansions. These animals are transparent and pelagic.

The present fossil cannot be included in the Tomopteridae, but it presents remarkable resemblances with that aberrant group. The head of the Tomopteridae is spread out laterally in what is described as tentacle-like extensions. These are followed by the very long *tentacular cirri* with acicular setae. Both structures are considered not as tentacles, but as derived from parapodia of "cephalised" body segments, because of their innervation. This cannot be studied in fossils but the presence of a structure resembling the "tentacular extensions" of the Tomopteridae and the suggestion of the presence of lateral extensions of the first parapodia behind these extensions of the head in specimen E5 suggest possible homologies. The "swimming paddles" of the Tomopteridae are considered as an extreme adaptation to pelagic life which cannot be expected in their ancestors. Its absence in *Spriggina* does not exclude pelagic habitat which is suggested by its association with jellyfish.

While further speculations on the mode of life of these fossils and of their relations to other annelids must await more detailed morphological and bi-stratonomic studies and further collecting, their possible significance for the problem of the origin of the arthropods should be mentioned. At present there is little information available for the elucidation of such relationships. *Spriggina* may exhibit primitive characters of the annelids. The relations of this ancient form with the living Tomopteridae suggest that their aberrant pelagic adaptations may conceal more primitive characters. They do not appear to have been considered in this connection by zoologists. The lateral extensions of the head of *Tomopteris* and its composite nature may foreshadow the formation of primitive arthropod head shields such as those of the Middle Cambrian Proarthropod (Trilobitomorph) *Marrella* and of trilobite larvae or primitive trilobites. For the first time an approach to arthropod origins on the basis of the study of a fossil annelid seems possible. The fact that the Arthropods may have originated earlier than the beginning of the Cambrian need not deter us, however, as even the much younger (Middle Cambrian) Burgess Shale fauna contains many primitive forms.

Another fossil from Ediacara is here placed on record though its affinities are entirely unknown. It is hoped that its publication will lead to further discoveries which may clarify its position:

Genus *PARVANCORINA* nov.gen.

Characters as described for its only species.

*Parvancorina minchami* nov.sp.

pl. I, fig. 4.

*Description*—A small shield-like body, oval in outline, slightly wider in front (?) where its margin is curved in a low arc, and gently tapering to the rounded end. Margins slightly raised so as to form a rim which is little more prominent at the wider end. The centre is occupied by a prominent, smooth, anchor- or T-shaped ridge which is unsegmented and undivided. It is separated by a distinct furrow from the anterior(?) rim, while its longitudinal bar rises above a flat surface between the converging posterior(?) contours. No appendages are known.

*Dimensions*—7 mm. long, up to 4 mm. wide.

*Holotype*—Specimen E 6A.

*Type locality*—Ediacara. Two small specimens representing the genus *Dickinsonia* Sprigg are seen on the same slab (E 6B and C).

*Age*—As for *Spriggina* (close to Precambrian-Cambrian boundary).

*Remarks*—In the absence of traces of segmentation, affinity with annelids could not be supported by facts; yet the thought that this could be a larval form may be worth mentioning.

In this connection the possibility that the enigmatic *Dickinsonia* which was recently (Harrington and Moore, 1955) made the only representative of the class Dipleurozoa and placed in the Coelenterata, may be an annelid, possibly remotely related to the Myzostomida, is here suggested. Many fine specimens have been collected by Messrs. Mincham and Flounders. The study of this new material will help to clarify the position of this distinctive genus.

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## EXPLANATION OF PLATE I

- Fig. 1-3.—*Spriggina floundersi* nov. gen., nov. sp. Fig. 1—Holotype, Fig. 2—Paratype (E 5), Figs. 3 a, b—Paratype (E 4), with different arrangement of lighting. The dark area in front of the head is probably one of the clay pellet impressions which are common in the rock, in accidental contact with the fossil.
- Fig. 4.—*Parancorina minchami* nov. gen., nov. sp. Holotype. All specimens from Pound Quartzite below base of Lower Cambrian Ajax limestone. Ediacara, South Australia. Coll. B. Flounders and H. Mincham. The lighting of the photographs was arranged so as to give maximum amount of detail, disregarding the possibility of negative (concave) features appearing positive (convex) to the viewer. All fossils are impressions (external moulds).
- Figs. 1-3:  $\times 2$ . Fig. 4:  $\times 5$ .